IN THE CLAIMS

Please amend the claims in accordance with the following.

Please cancel Claims 10, 17, 25, and 32 without prejudice or disclaimer of the subject matter contained therein.

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1. (AMENDED) Fuzzy logic method of tuning [an RF] a radio frequency (RF) matching network of the type having an input at which is applied RF power at a given frequency and at a given impedance, and an output which applies said power to an RF load having a non-constant impedance, said matching network including a phase-magnitude error detector means providing a phase error signal and a magnitude error signal related respectively to impedance phase angle error and impedance magnitude error, and said matching network comprising at least a first variable impedance having a driven element for varying the impedance thereof and a second variable impedance having a driven element for varying the impedance thereof; the method comprising:

supplying said phase and said magnitude error signals to a fuzzy logic controller, wherein each of said error [signal] signals has a magnitude and direction[,] ;

applying each of said phase and magnitude error [signal] signals to a fuzzy logic inference function based on a number of overlapping fuzzy sets, and where [the] a value of each of said phase and magnitude error [signal] signals enjoys membership in one or more fuzzy sets;

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applying fuzzy logic rules to said phase and magnitude error signals according to [the] said one or more fuzzy sets for which said [first and second] phase and magnitude error signals enjoy membership;

obtaining drive signal values based on said fuzzy logic rules for each of said phase and magnitude error signals;

weighting said drive signal values according to the respective one or more fuzzy sets inference [functions] for which said phase and magnitude error signals enjoy membership; and

combining said weighted drive signal values to produce an output drive signal for said first variable impedance device driven element.

2. (AMENDED) Fuzzy logic method of tuning an RF matching network according to claim 1, further comprising

obtaining additional drive signal values based on additional fuzzy logic rules for each of said first and second error signals;

weighting said additional drive signal values according to additional respective fuzzy inference functions; and

combining [such] said weighted additional drive signal values to produce an output drive signal for said second variable impedance device driven element.

3. (AMENDED) Fuzzy logic method of tuning an RF matching network according to claim 2, wherein said fuzzy logic rules and said additional fuzzy logic rules comprise a matrix of NxM drive signal values, where N is the number of fuzzy sets of

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said [phase] first error signal and M is the number of fuzzy sets of said [magnitude] second error signal, and each of said drive signal [value] values and said additional drive signal values corresponds to a given set of said [phase] first error signal and a given set of said [magnitude] second error signal.

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4. (AMENDED) Fuzzy logic method of tuning an RF matching network according to claim 1, wherein said number of overlapping fuzzy sets [being] are centered respectively about zero, a medium positive value, a medium negative value, a high positive value, and a high negative value.

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5. (AMENDED) A fuzzy logic controller for tuning [an RF] a radio frequency (RF) matching network, wherein said matching network is positioned between a source of applied RF power at a given frequency and at a given impedance, and an RF load having a non-constant impedance, said matching network including a phase-magnitude error detector means providing a phase error signal and a magnitude error signal related respectively to impedance phase angle error and impedance magnitude error, and said matching network comprising at least a first variable impedance device having a driven element for varying the impedance thereof and a second variable impedance device having a driven element for varying the impedance thereof; the fuzzy logic controller comprising input means receiving values of said phase and magnitude error signals; means for applying the values of said phase and magnitude error signals to a fuzzy logic inference function based on a number of overlapping fuzzy sets, and where a [the values] valu of each of said phase and magnitude error signals enjoy

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membership in one or more fuzzy s ts; means for applying fuzzy logic rules to said phase and magnitude error signals according to fuzzy sets for which said error signals enjoy membership; means for obtaining drive signal values according to said fuzzy logic rules for each [set] of said fuzzy sets for which said error signals enjoy membership; means for weighting said drive signal values according to the respective fuzzy inference functions for the values of said phase and magnitude error signals; and means for combining said weighted drive signal values to produce an output drive signal for said first variable impedance device driven element.

6. (AMENDED) Fuzzy logic controller according to claim 5, further comprising means for obtaining additional drive signal values based on additional fuzzy logic rules for each of said phase and magnitude error signals; means for weighting said additional drive signal values according to additional respective fuzzy inference functions; and means for combining [such] said weighted additional drive signal values to produce an output drive signal for said second variable impedance device driven element.

7. (AMENDED) Fuzzy logic method of tuning a tunable [RF] radio frequency (RF) device of the type having an input at which is applied RF power at a given frequency and at a given impedance, and an output, including an error detector means providing a first error signal and a second error signal, and said tunable RF [means] device including at least a first variable impedance device having a driven

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element for varying the impedance thereof and a second variable impedance device having a driven element for varying the impedance thereof; the method comprising:

supplying said first and said second error signals to a fuzzy logic controller, wherein each of said first and said second error [signal] signals has a magnitude and direction[,] ;

applying each of said first and said second error [signal] signals to a fuzzy logic inference function based on a number of overlapping fuzzy sets, and generating a membership value that corresponds to [the] an amount of overlapping membership of the error signal value in one or more fuzzy sets;

applying a plurality of fuzzy logic rules to said first and second error signals according to the fuzzy sets for which said first and second error signals enjoy membership;

obtaining a plurality of drive signal values based on said plurality of fuzzy logic rules for each of said first and second error signals;

weighting said drive signal values according to the respective membership values for said first and second error signals; and

combining said weighted drive signal values to produce an output drive signal for said first variable impedance having said first variable impedance device driven element.

8. (AMENDED) Fuzzy logic method of tuning a tunable RF device according to claim 7, further comprising

obtaining a plurality of additional drive signal values based on additional fuzzy logic rules for each of said first and second error signals;

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weighting said additional drive signal values according to a plurality of additional respective fuzzy inference functions; and

combining such weighted additional drive signal values to produce an output drive signal for said second variable impedance device driven element.

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9. (AMENDED) An electrical network comprising:

a radio frequency (RF) generator for generating an RF signal, the RF generator having a source impedance;

a load receiving the RF signal, the RF signal providing a driving energy to the load, the load having a variable load impedance;

a matching network interposed between the RF generator and the load, the matching network having a variable network impedance, the matching network detecting at least one of an impedance phase and an impedance magnitude error and generating at least one of a respective phase error signal and a magnitude error signal, the matching network varying at least one of the impedance phase and the impedance magnitude error in order to vary the network impedance;

a fuzzy inference module receiving the at least one of the respective phase and magnitude error signals and defining a membership value that varies in accordance with membership in at least one fuzzy set; and

a controller receiving the at least one respective phase error signal and magnitude error signal, the controller applying the fuzzy logic rules to the at least one of

Sub C3 Concld B3

the respective impedance phase error signal and the impedanc magnitude error signal according to the fuzzy sets for which said restrictive error signals enjoy membership in order to generate at least one control signal to vary the network impedance, thereby matching the source impedance and the load impedance.

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~~11.~~ 10 (AMENDED) The network of claim 9 wherein the controller further comprises a rules module having a set of rules applied in accordance with the membership values, the rules module generating at least one fuzzy output.

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12. (AMENDED) The network of claim 10 wherein the controller further comprises a defuzzification module, the defuzzification module converting the at least one fuzzy output to the at least one control signal.

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16. (AMENDED) An electrical network comprising:

a radio frequency (RF) generator for generating an RF signal, the RF generator having a source impedance;

a load receiving the RF signal, the RF signal providing a driving energy to the load, the load having a variable load impedance;

a matching network interposed between the RF generator and the load, the matching network having a variable network impedance, the matching network detecting at least one network parameter and generating at least one sensed signal, the matching network varying the network impedance in order to match the variable load impedance and the source impedance, wherein the at least one sensed signal

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compris s at l ast one of an impedance phase error signal and an impedance magnitude error signal;

a fuzzy inference module receiving the at least one sensed signal and defining a membership value that varies in accordance with membership in at least one fuzzy set; and

a controller receiving the at least one sensed signal, the controller applying fuzzy logic rules to the at least one sensed signal according to the fuzzy sets for which said first and second error signals enjoy membership in order to generate at least one control signal to vary the network impedance, thereby matching the source impedance and the load impedance.

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16 ~~18.~~ (AMENDED) The network of claim 15 ~~16~~ wherein the controller further comprises a rules module having a set of rules applied in accordance with the membership value, the rules module generating at least one fuzzy output.

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19. (AMENDED) The network of claim 16 wherein the controller further comprises a defuzzification module, the defuzzification module converting the at least one fuzzy output to the at least one control signal.

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21 ~~23.~~ (AMENDED) The network of claim 15 ~~16~~ wherein the load is a RF plasma chamber.

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24. (AMENDED) A method of tuning a radio frequency (RF) impedanc matching network having an input which receives RF power and an output which applies the power to a RF load, the matching network having a variable impedance, comprising the steps of:

determining an impedance phase error and an impedance magnitude error and generating a corresponding phase error signal and a corresponding magnitude error signal;

applying the phase impedance and magnitude impedance error signals to a fuzzy logic inference function, the phase and magnitude error signals each having at least one respective membership value in at least one fuzzy set; and

applying fuzzy logic rules to the impedance phase and impedance magnitude error signals according to the fuzzy sets for which said error signals enjoy membership to generate fuzzy output signals based upon the phase and the magnitude error signals and generating a control signal to adjust the variable impedance of the matching network.

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~~26.~~ (AMENDED) The method of claim ~~24~~ 22 wherein the step of applying fuzzy logic further comprises applying logic rules to the at least one respective membership value to generate at least one respective fuzzy output value.

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27. (AMENDED) The method of claim 24 wherein the step of applying logic rules further comprises the step of weighting the at least one respective fuzzy output value according to the at least one respective membership value.

25 ~~28.~~ (AMENDED) The method of claim 24 ~~27~~ wherein the step of applying logic rules further comprises the step of combining said weighted at least one respective fuzzy output values to produce the control signal.

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26 ~~29.~~ (AMENDED) The method of claim 22 ~~24.~~ wherein the logic rules comprise a matrix of NxM fuzzy output values, where N is the number of fuzzy sets of a first sensed signal and M is the number of fuzzy sets of a second sensed signal, and each fuzzy output value corresponds to a predetermined set of the first sensed signal and a predetermined set of the second sensed signal.

27 ~~30.~~ (AMENDED) The method of claim 22 ~~24~~ wherein the at least one fuzzy set comprises a plurality of fuzzy sets centered respectively about zero, a medium positive value, a medium negative value, a high positive value, and a high negative value.

31. (AMENDED) A method of tuning a radio frequency (RF) impedance matching network having an input which receives RF power and an output which applies the power to a RF load, the matching network having a variable impedance, comprising the steps of:

determining a network parameter and generating a corresponding sensed signal that varies in accordance with the network parameter;

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applying the corresponding s nsed signal to a fuzzy logic inference function, the corresponding sensed signal having at least one respective membership value in at least one fuzzy set; and

applying fuzzy logic rules to the corresponding sensed signal according to fuzzy sets for which said error signal enjoys membership;

generating fuzzy output signals based upon the corresponding sensed signal; and

generating a control signal to adjust the variable impedance of the matching network based upon the fuzzy output signals.

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33. (AMENDED) The method of claim 31 wherein the step of applying fuzzy logic further comprises applying logic rules to the at least one respective membership value to generate at least one respective fuzzy output value.

34. (AMENDED) The method of claim 31 wherein the step of applying logic rules further comprises the step of weighting the at least one respective fuzzy output value according to the at least one respective membership value.

35. (AMENDED) The method of claim 34 wherein the step of applying logic rules further comprises the step of combining said weighted at least one respective fuzzy output values to produce the control signal.

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~~36.~~ (AMENDED) <u>The method of claim ~~31~~, wherein the logic rules comprise a matrix of NxM fuzzy output values, where N is the number of fuzzy sets of the corresponding sensed signal and M is the number of fuzzy sets of a second sensed signal, and each fuzzy output value corresponds to a predetermined set of the sensed signal and a predetermined set of the second sensed signal.</u>

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~~37.~~ (AMENDED) <u>The method of claim ~~31~~ wherein the at least one fuzzy set comprises a plurality of fuzzy sets centered respectively about zero, a medium positive value, a medium negative value, a high positive value, and a high negative value.</u>

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